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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : A61M A2

(11) International Publication Number: WO 00/38755

(43) International Publication Date: 6 July 2000 (06.07.00)

(21) International Application Number: PCT/US99/30702

(22) International Filing Date: 23 December 1999 (23.12.99)

(30) Priority Data:
60/113,732 23 December 1998 (23.12.98) US

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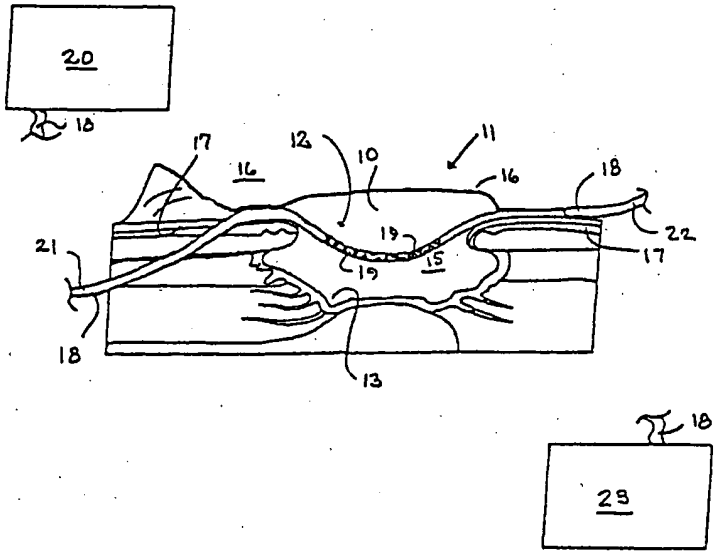
(81) Designated States: AU, CA, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: METHOD AND APPARATUS FOR WOUND TREATMENT



(57) Abstract

A wound treatment device comprises a polyurethane or polyether foam pad, adapted for insertion substantially within a wound cavity; a pump for supplying fluid flow to the wound site; and a collection canister for receiving wound fluids drawn from the wound cavity. The foam pad, pump and collection canister are in fluid communication with one another through a single hospital grade hose having a plurality of tiny apertures in the portion that is central to the foam pad. These apertures are adapted to allow fluids from the wound cavity to be drawn into the flow from the pump to the canister according to Bernoulli's theorem.

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METHOD AND APPARATUS FOR WOUND TREATMENT

TECHNICAL FIELD:

The present invention relates to the treatment of wounds. More particularly, the invention relates to the therapeutic application of a positive fluid flow to a wound site for the promotion of wound healing.

BACKGROUND ART:

It is known in the prior art that wound closure requires that the epithelial and subcutaneous tissues adjacent the wound migrate toward the wound. Unfortunately, in the case of large or infected wounds, such as are often the result of chronic disease or pressure sores, spontaneous closure does not take place. In these cases, localized swelling forms near the surface of the wound restricting the flow of blood. As a result of this diminished blood flow the wound is unable to successfully fight bacterial infection. The resulting increased infection in turn causes further restriction of blood flow, which results in further diminished blood flow and so forth, ultimately leading to the necessity for radical intervention. In many cases, the patient requires hospitalization for drug administration and/or surgical relief.

The application of continuous negative pressure has been shown to contribute significantly to wound closure. Such applications typically involve the insertion of an open-cell foam pad into a wound region. The pad is then covered with a polymer sheet to seal the

region from atmosphere. Thereafter, negative pressure is applied to the wound site through a tube having one end inserted into the interior of the foam pad and the opposite end attached to a vacuum pump via an interposed chamber for collection of wound fluids. Clinical results demonstrate that such applications of negative pressure promote the migration of epithelial and subcutaneous tissue toward the wound while serving to evacuate wound exudate and reduce bacterial density.

Unfortunately, the application of continuous negative pressure makes difficult the administration of topical disinfectant drugs and control of the local atmospheric content and does little to promote drying of the wound area. It is therefore desired to achieve infection control in a manner that promotes the application of topical disinfectants while allowing the caregiver to adjust the local atmospheric condition, including content and temperature. The removal of wound fluids through continuous negative pressure also suffers the disadvantage of requiring strict infection control. This is most often accomplished through the provision of very expensive hydrophobic filters between the collection canister and vacuum pump and other safety measures. It is therefore desired to eliminate necessity for such expensive apparatus while still providing a safe and effective means for exudate removal.

DISCLOSURE OF THE INVENTION:

In accordance with the foregoing objects, the present invention – a method and apparatus for wound treatment – generally comprises a polyurethane or polyether foam pad, adapted for insertion substantially within a wound cavity; a pump for supplying fluid flow to the wound site; and a collection canister for receiving wound fluids drawn from the wound cavity. The foam pad, pump and collection canister are in fluid communication with one another through a single hospital grade hose having a plurality of tiny apertures in the portion that is central to the foam pad. These apertures are adapted to allow fluids from the wound cavity to be drawn into the flow from the pump to the canister according to Bernoulli's

theorem.

Many other features, objects and advantages of the present invention will be apparent to those of ordinary skill in the relevant arts, especially in light of the foregoing discussions and the following drawings, exemplary detailed description and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS:

Although the scope of the present invention is much broader than any particular embodiment, a detailed description of the preferred embodiment follows together with illustrative figures, wherein like reference numerals refer to like components, and wherein:

Figure 1 shows a partial cross section of a known apparatus for application of continuous negative pressure to a wound site; and

Figure 2 shows a partial cross section of a the preferred embodiment of the present invention as applied to a wound site, including in block diagram the pump and collection canister forming a part thereof.

BEST MODE FOR CARRYING OUT THE INVENTION:

Although those of ordinary skill in the art will readily recognize many alternative embodiments, especially in light of the illustrations provided herein, this detailed description is exemplary of the preferred embodiment of the present invention, the scope of which is limited only by the claims that may be drawn hereto.

Referring to Figure 1, there is shown a partial cross-sectional view of an open cell polyurethane or polyether foam pad 10 as inserted into a wound site 11 for application of continuous negative pressure as previously known in the art. As detailed in the figure, the foam pad 10 is cut to size so as to pack the foam 10 into the wound cavity 12, making contact with the full surface 13 of the cavity 12. A drainage tube 14, preferably comprising medical grade polyvinyl chloride (PVC), is terminated within the central portion 15 of the foam pad

10 and the pad 10 and tube 14 combination is covered with a surgical drape 16. The drape 16 is preferably adhered firmly to the intact skin 17 peripheral the wound site 11 as well as to the drainage tube 14 in order to provide an air-tight seal around the wound 11. Negative pressure is then applied though the drainage tube 14 utilizing known apparatus not shown here.

Referring now to Figure 2, there is shown a partial cross-sectional view of an open cell polyurethane or polyether foam pad 10 as inserted into a wound site 11 for application of positive pressure according to the teachings of the present invention. While the present invention employs many principles known from the art of negative pressure applications for wound site preparation, material selection and even therapeutic modality, the present invention varies from the known art in several critical areas. First, the present invention is adapted to apply a positive pressure to the wound site 11. As shown in the figure, the PVC tube 18 providing fluid communication both to and from the inserted pad 10 comprises a plurality of tiny apertures 19 in the region 15 central to the pad 10. Positive pressure, preferably generated with a non-oil type clean air delivery pump 20 meeting applicable hospital standards such as UL-544, is delivered to a first end 21 of the tube. By varying the temperature and flow rate of the fluid delivered to the wound site 11 through the tube 18 and provided apertures 19, the caregiver is given the ability to control the drying characteristics of the fluid. Additionally, the caregiver can vary the content of the fluid in order to promote increased healing. For example, the pump 20 may be adapted to deliver pure O_2 for a localized hyperbaric effect or O_3 for ozone treatment and infection controlling drugs may be easily admitted into the flow stream for topical administration to the wound 11.

In addition, the placement of the tiny apertures 19 in the flow stream relative to the second, or drainage, end 22 of the tube 18 creates a venturi. As is generally known in the relevant arts, a venturi operates through the Bernoulli effect to create a relative low pressure in areas of increased fluid flow rate in a closed or semi-closed system. According to the

present invention, the drainage end 22 of the tube 18 is connected to fluid collection canister 23 wherein the local pressure is controlled to ensure establishment of the desired venturi. In this manner, a localized suction is created at the wound site 11, notwithstanding the fact that the pressure at the wound 11 will be greater than that of the surrounding atmosphere, whereby wound exudate may be safely drawn from the wound 11. This helps to eliminate moisture buildup at the wound site 11 and reduces bacterial density, thereby aiding in the control of infection and assisting in the control of edema.

As an additional benefit, the system of the present invention eliminates the need for many of the more expensive elements of infection control. For example, because the collection canister 23 is at the terminal end of the pressure delivery apparatus, the requirements for hydrophobic filtering and strict contamination monitoring are reduced or eliminated. This makes the apparatus of the present invention available at far more economical rates, while maintaining patient safety standards intact.

While the foregoing description is exemplary of the preferred embodiment of the present invention, those of ordinary skill in the relevant arts will recognize the many variations, alterations, modifications, substitutions and the like as are readily possible, especially in light of this description and the accompanying drawings and claims drawn hereto. In any case, because the scope of the present invention is much broader than any particular embodiment, the foregoing detailed description should not be construed as a limitation of the scope of the present invention, which is limited only by the claims that may be drawn hereto.

INDUSTRIAL APPLICABILITY:

The present invention is applicable to the art of wound healing.

CLAIMS:

What is claimed is:

1. An apparatus for the promotion of wound closure, said apparatus comprising:

a pad adapted for insertion substantially within a wound cavity;

a source of fluid flow;

a reservoir adapted for collection of wound fluids; and

a fluid conduit adapted for conveying said fluid flow from said source, through said pad and to said reservoir, said fluid conduit being further adapted to draw wound fluids from adjacent said pad into said fluid flow and away from the wound cavity.

2. The apparatus as recited in claim 1, wherein said adaptation to draw wound fluids comprises an implementation of Bernoulli's theorem.

3. The apparatus as recited in any of the preceding claims, wherein said fluid conduit comprises a hose.

4. The apparatus as recited in any of claims 2 or 3, wherein said implementation comprises the provision of a plurality of apertures in said fluid conduit, said apertures being enveloped within said pad.

5. The apparatus as recited in any of the preceding claims, wherein said fluid source is adapted for the introduction to said fluid flow of a pharmaceutical product.

6. The apparatus as recited in any of the preceding claims, wherein said fluid source is adapted for the influence, through said fluid conduit, of the atmospheric condition in the region of the wound cavity.

7. The apparatus as recited in claim 6, wherein said influence comprises effecting atmospheric content.

8. The apparatus as recited in any of claims 6 or 7, wherein said influence comprises effecting temperature.

9. The apparatus as recited in any of the preceding claims, wherein said reservoir comprises a canister.

10. A method for the promotion of wound closure, said method comprising the steps of:

inserting a pad substantially within a wound cavity;

providing a source of fluid flow;

providing a reservoir adapted for collection of wound fluids; and

conveying said fluid flow through a fluid conduit from said source, through said pad and to said reservoir, said fluid conduit being adapted to draw wound fluids from adjacent said pad into said fluid flow and away from the wound cavity.

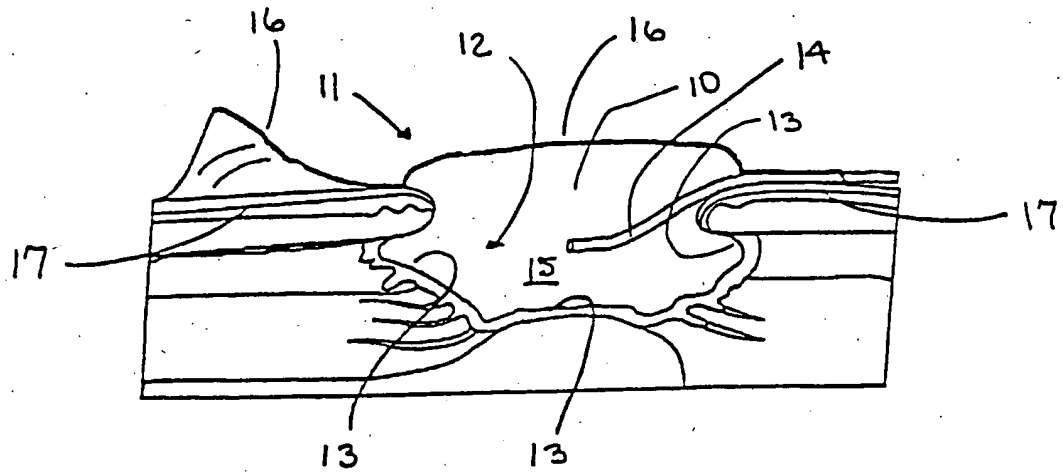

FIGURE 1

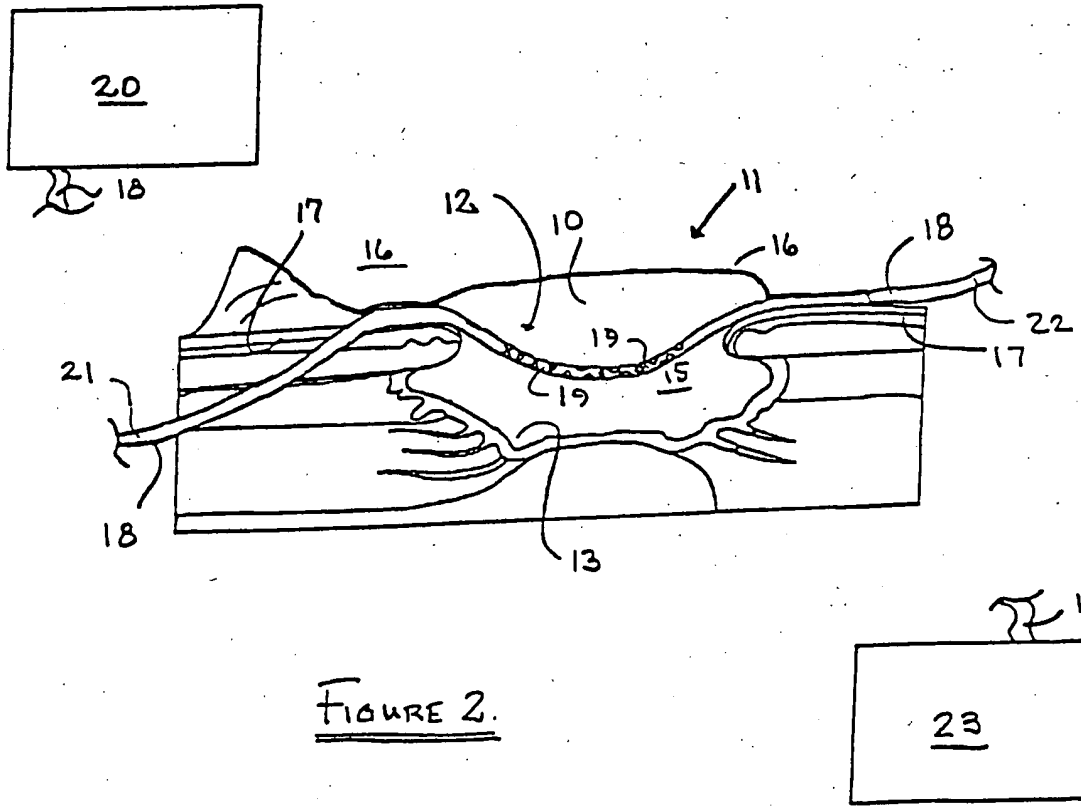

FIGURE 2.

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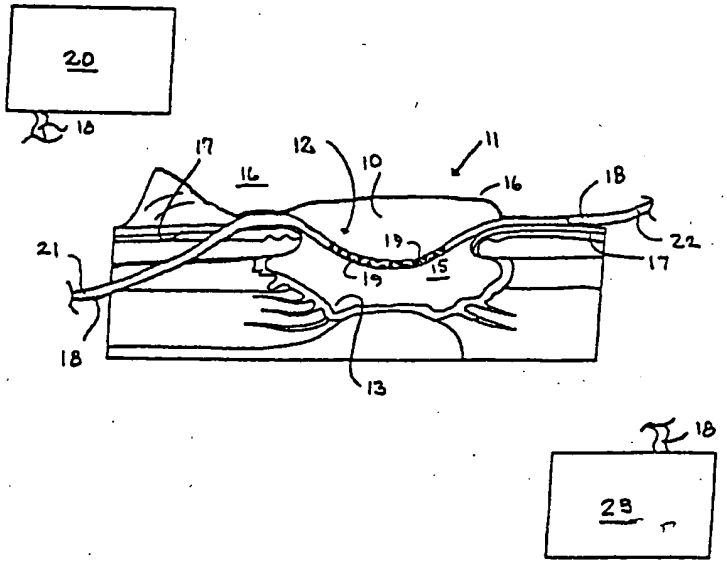
Published
With international search report.

(88) Date of publication of the international search report:
23 November 2000 (23.11.00)

(54) Title: METHOD AND APPARATUS FOR WOUND TREATMENT



(57) Abstract

A wound treatment device comprises a polyurethane or polyether foam pad (10), adapted for insertion substantially within a wound cavity; a pump (20) for supplying fluid flow to the wound site, and a collection canister (23) for receiving wound fluids drawn from the wound cavity. The foam pad (10), pump (20), and collection canister (23) are in fluid communication with one another through a single hospital grade hose (14) having a plurality of tiny apertures (19) in the portion that is central to the foam pad. These apertures (19) are adapted to allow fluids from the wound cavity to be drawn into the flow from the pump (20) to the canister (23) according to Bernoulli's theorem.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/30702

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :A61M 35/00
US CL :604/290
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 604/28, 35, 290

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 1,114,268 A (KELLS) 20 OCT 1914, Fig.2 and related text.	1,3-7, 9, 10
Y	US 4,421,505 A (SCHWARTZ) 20 DEC 1983, Figs 1-3 and related text.	1-10
Y	US 5,636,643 A (ARGENTA et al.) 10 JUN 1997, Fig. 1 and related text.	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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15 AUGUST 2000	18 SEP 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer MICHAEL J. HAYES Telephone No. (703) 305-5873

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